

Some Land Surveying Problems

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Land surveying problems confronting the land surveyor might well be placed in two general classifications; one, the mechanical and mathematical solution of given problems, and secondly that type of problem where the surveyor must exercise judgment and knowledge of land surveying procedures.

It is not probable that many of you would be interested in the academic presentation of a method for finding the area of a given polygon, as you each have a system of your own which is probably mathematically acceptable. However, I might take the liberty of citing to you pages 300 and 301 in *Engineering Surveys, Elementary and Applied*, by Rubey, Lommel, Todd, where you will find a good discussion of how to find areas by the double meridian distance method and also how to find areas by the use of the rectangular coordinate method. There are dozens of other textbooks on surveying which will also explain these same methods for finding areas.

Let us proceed to some of the basic understandings which we should all possess as land surveyors. There may be hundreds of specific problems, but perhaps we can cover many of those specific problems by making some general statements and setting out some of the main principles which we should clearly understand

The first two questions the client will likely ask you, and frequently in almost the same breath are: "How soon can you do the job?" and "How much will it cost?" To the first question you can probably give a reasonable answer, but the second question (cost) may be more difficult to answer, and frequently the cost seems unreasonably high to your client. We can't set a salary schedule here, but we can agree again concerning the principles upon which to base our charges. Certainly it is not unreasonable for us to say that our minimum fee should be that amount necessary for us to perform the service asked on a recognized professional level. And what is that level? For a good answer, I suggest you read the "Recommendations for use in Preparation of Fee Schedules—American Congress on Surveying and Mapping."

OBLIGATIONS AND LIABILITIES

As a land surveyor, what do you owe to your client and what are your liabilities? You are obligated to bring to each job only that professional competence which any land surveyor would bring to the job. If you complete a task by the use of procedures which any other average land surveyor would use under like conditions, then you have perhaps discharged your duties in a manner satisfactory to the law. Absolute accuracy is by no means guaranteed or implied in the above statements.

There is no place in our profession for the man who implies that for a higher price he will do a "better job" of surveying! *All* of the work we do should be done to the very *best* of our ability, and with the thought in mind that we might need to defend our actions and procedures in court; in fact, there is where your liabilities might first dawn upon you!

If you are employed to make a lot survey and erroneously locate the line so that the client builds over on his neighbor's land, you are very likely liable for the damages which your client suffers in moving his house, or acquiring the extra land needed! Doesn't it seem that the realization of such liability on the part of the surveyor would almost automatically eliminate the cursory five-dollar lot survey? Of course, if you merely made the mistake of parting off too much land, you would probably lose only the amount of your fees for the job. These two liabilities should serve to make us proceed with great care so that our actions can be defended in court, and shown to be those of an ordinary prudent land surveyor. And you should remember that your liability is the same whether you are a county surveyor, or a private surveyor.

EXCESS AND DEFICIENCY

Excess and deficiency will frequently pose a knotty problem for the land surveyor, as it is seldom that present day measurements will agree with ancient measurements. When making lot surveys in a platted city or town block, the whole block must be investigated before determining the final location of the lot lines. On the assumption that there are no good evidences of lot lines, the excess or deficiency must be apportioned to the various lots according to their respective frontages.

However, the surveyor must clearly realize all the ramifications of adverse possession, and pay due respect to ancient fences. You

will meet these problems out in the field, and in a good many instances you must make your decisions right there *in* the field. Justice and fairness certainly should be the essence of all decisions which you may make.

In the rural areas, you are all aware of the fact that rarely do we find the distance from one section line to another section line to be 5,280 feet, nor will the half-mile contain 2,640 feet, nor will the quarter-mile contain 1,320 feet. I happen to remember a particular quarter-mile which measured 1,343.3 feet.

Whenever a distance is measured and found to be different than the value given in the original land survey, it is proper that it be recorded as the true distance which you found it to be. When new descriptions are written, there is no reason why an incorrect distance should be recorded in the new description just because it has appeared incorrectly in dozens of previous descriptions. It certainly isn't wrong to record distances (and angles, too) as they actually exist upon the ground.

Of course, there are many "paper surveys" on record where land line intersection angles are always 90° and the distances are all proper divisions of 5,280 feet. I have yet to find two intersecting land lines which form an angle of exactly 90° . The distances and angles should, and must be, recorded as they actually exist, if our surveys are to mean anything.

LAND DESCRIPTIONS

Descriptions may develop some problems for the land surveyor. Most of the resurveys which are made today must have a former description as a basis of the resurvey. Interpretation of an old description, and the following of the description out on the ground, may become a major problem, and it is here that the knowledge and experience of the surveyor stands him in good stead. Of course, it is well known that old monuments, found and proven without doubt, constitute about the best evidence of the beginning and the end of a given line. However, we all know, too, that the actual location of and finding of those old monuments might even tax the ability of a Sherlock Holmes.

Where highways and roads have been constructed upon section lines, the chances are at least fifty-fifty that you will not be able to uncover the original monuments, and here is where the land surveyor must exercise some ingenuity. Witnesses have long since disappeared in most communities, and the surveyor must use his

best judgment—keeping in mind that he should follow a procedure acceptable to any other prudent land surveyor called upon to do the same job.

In many parts of Indiana, this rectangular land system is quite evident upon the ground, and is frequently marked by fences of long standing. These fences are land monuments, and mark and determine the ownership of property, just as well as the old original monuments placed at the section corners and subdivisions of the section. It is presumed that those fences were built from land corner to land corner, when the corners were in existence, and therefore are about the best evidence of where the land line once was. Regardless of what distances might be called for in a description, the old original monuments would prevail, but where those monuments can no longer be uncovered, then great weight must be given to ancient fences.

The study of an aerial photograph of the area to be resurveyed is often of much help, as those old land lines often show up very distinctly from a photo taken some 20,000 feet in the air. Aerial photos are available in all counties of Indiana, as the AAA had the state "flown" back in 1937 in connection with the crop allotment program. A birds-eye-view of your whole surveying job is right there before your eyes, and you can even have depth-perception of the area by the use of the stereoscope. This could be of real value on large subdivision jobs.

In writing the new description, there is no reason why the surveyor should hold to the ancient legal terminology so frequently found in descriptions. Present day distances, as they exist upon the ground, should be used, and it seems that perhaps the angles at corners should be recorded, rather than the usual bearings. Why not place the angular value at the corner, rather than have to compute it from a bearing (perhaps incorrect bearing) each time you might want the angle?

There may not be a "standard" for a perfect description, but a good description should be as brief and concise as possible, give the essential data, and be written in language which is not confusing. Legal phraseology can be eliminated completely, as it merely confuses the average person. It seems that a scale drawing of the survey should be attached to and made a part of the description and if a transit-tape survey has been made, the 1/d for the traverse should be clearly indicated. While the 1/d of the survey does not mean much to the layman, it does have some value

to the professional land surveyor, and is an indicator of the general quality of the work for that survey.

SUB-DIVISION SURVEYS

At present, the land surveyor is frequently called upon to make the survey for a sub-division adjacent to or within city limits and he should have a clear understanding of the steps involved. It seems obvious that if we are to divide a given area we must know how much area there is to divide; therefore, the first thing to do is to make a boundary survey of the area involved, and be sure we have an acceptable 1/d. Many cities have specifications governing the making of subdivisions, stating minimum widths for streets, sight distances on curves, types of monuments which shall be used, etc.

West Lafayette specifications call for a 1/d of 1/5000 for sub-division work, which is not at all unreasonable, as many farm surveys will be of this order or even higher. Along with the boundary survey it may be found desirable to make a topographic survey of the area, especially if the land is rolling to rough, and the streets and lots are to take advantage of the lay of the land.

After the boundary and topographic survey have been drafted on tracing paper, or cloth, tentative street and lot lay-outs can be developed and studied, and shown to the client for approval. When a satisfactory lay out is developed on paper you can start to actually lay out the streets and lots in the field, and you will find out that dimensions which were scaled on your tentative lay-out plan will not always work out in the field. The setting of iron stakes and concrete monuments should be done at this time and the actual distances and angles measured and recorded on your final map.

When curved streets are used in a sub-division, all the pertinent curve data should be shown on the map for future reference, as the relocation of lot lines along curved streets is somewhat difficult when the curve data is missing. The surveyor 25 years hence will not be as familiar with the job as you are right now. When the final map is completed, with all distances and angles recorded as they actually exist in the field, the certification and seal of the surveyor should be appended to the map. Of course, there will also need to be the proper statements concerning dedication, restrictions, and places for signatures of proper county and/or city officials.

And finally, in due course of time, your client will probably have the plot recorded. Extreme care should be taken by the surveying crew when measuring the angles at lot corners and the distances between monuments at the lot corners. Permanent monuments should be established at every lot corner, but what constitutes a *permanent* monument? As the years pass, and lots here and there in the subdivision are developed, monuments will be moved, obliterated, or lost, and then the angles and distances on adjacent lots are of great value to the future surveyor when he is called upon to retrace a doubtful lot line. Thorough referencing of important corners can not be over-stressed, although it is recognized that permanence in reference points is just as difficult to attain as permanence in the monument itself; however, we should not ignore the use of references for this reason alone.

A FAIR CHARGE

And now that you have developed an acceptable subdivision plot for your client, and helped steer him through the various laws governing the development of that plot, how much is a fair charge? You have taken land worth perhaps two or three hundred dollars per acre, and by your knowledge and effort changed it into land worth perhaps five to seven thousand dollars per acre—yes, perhaps up to twenty or twenty-five thousand dollars per acre! It seems to me that you have created wealth, and under our free enterprise system you should be allowed to participate in that wealth. How much? Here again you will need to exercise judgment and discretion, but as land surveyors, we might look to other professions in our society and be governed accordingly.